

Learning Space Guidelines v1.1.2

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About these guidelines

These guidelines have been produced to help those who are requesting, specifying, designing, supplying, installing, maintaining facilities and environments in UCL's learning spaces.

E-Learning Environments within Information Services Division have led the creation of these guidelines in consultation with the following groups:

- Learning and Teaching Spaces (formerly the Audio Visual Centre)
- Estates Room Booking Team

Going forward the aim is to consult all relevant stakeholder groups and comments and feedback are welcomed at any time (see email below).

These guidelines are not intended to be incontrovertible. It is hoped that users will inform the future refinement of these guidelines and they will become a living document that will evolve over time rather than a document that gradually loses its validity.

In the context of projects for new or refurbished space projects the guidelines should be used in conjunction with any information gained from the local users of the space and the instructions produced by architects, developers or UCL Estates working on the project.

Unless stated otherwise all measurements are in mm.

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Section 1: Types of learning space

There are a variety of types of learning space within UCL. Below are the three main categories of teaching space as described by Estates with additional sub-categories within those.

Lecture Theatres – these spaces have fixed furniture

- **Large Lecture Theatres** – these spaces accommodate in excess of 50 students, generally have a raked floor and are arranged with fixed seating facing the front.
- **Small Lecture Theatres** – 7 of these spaces exist at UCL and they accommodate less than 50 students in fixed seating on a flat floor. Most other institutions would not refer to spaces of this size as lecture theatres.

Classrooms – these spaces have movable furniture

- **Classrooms** – at UCL these spaces accommodate between 6 and 80 students and can have a variety of non-fixed furniture types.

Public Cluster – these spaces have desktop PCs

- **IT cluster spaces** – these spaces provide access to IT equipment and at UCL range in capacity from 10 to 70 individual computers. Generally are available for individual students to use when they are not booked for teaching IT related topics.

Non-teaching spaces – there are also other types of centrally managed learning space beyond the above three Room Bookings categorizations. These spaces are available for student use during the opening hours of the appropriate building.

- **Open-Access computer rooms (cluster spaces)** – these spaces provide access to IT equipment and at UCL these range in capacity from 10 to 170 individual computers.
- **Informal learning spaces** – these spaces could be of any size and are not used for teaching. The learning function of the space may be combined with another function (e.g. linking space between buildings or function room at certain times).
- **Small group working spaces** – these spaces accommodate between 3 and 8 students. They can be bookable (usually through the Library issuing system).

Departmental/Faculty managed learning spaces – these spaces are not included in the Room Bookings listings and their management/booking is undertaken within the department/faculty.

- **Classrooms** – there is a wide variety departmentally/faculty managed classrooms within UCL.
- **Specialist workshops or laboratories** – there is a wide variety of this type of space but it is not within scope of these guidelines.
- **Common room spaces** – these spaces provide areas to socialise and relax. They are not specifically designed to support learning but may accommodate facilities for this and may be used by students for this purpose.

Non-space facilities – these are not specific spaces but instead facilities that support student learning and are located within spaces that may or may not be learning focussed.

- **Technology touchdown points** – these are facilities for students to use their own portable/mobile technology in conjunction with University provided services. These are also sometimes referred to as ‘Perch Points’.
 - **Technology quick access points** – these are facilities for students to use University provided technology to quickly access online services (e.g. check email, check library catalogue).
-

Section 2: Generic Guidance for all Learning Spaces

All learning spaces should be as accessible to learners as is reasonably practicable. It is recognised that much of the UCL estate comprises historic and often listed buildings that may make achieving universal accessibility difficult or impossible for certain locations. Where there are accessibility issues for certain spaces this should be recognised in listings of spaces (e.g. online room bookings system) and route signage (to prevent the avoidable frustration of journeys that cannot be completed).

The times that a space is available should shown in both online listings of spaces and direct signage outside the entrance to the space. This signage can be static (e.g. paper sheets in frames) or electronic (digital signage). For spaces that are available for learners to use without staff presence (e.g. IT Cluster spaces) the availability of the space, and the facilities within it in respect of IT facilities, should be accessible via the online PC Availability service (visible in the UCL Go! mobile app and on the ISD website).

Doors onto learning spaces should, where possible, contain glazed vision panels so that it can be seen if there is a teaching session in progress prior to entering and the risk of accidents caused by doors opening onto other people is minimised. Opportunities to achieve this are, for example, when doors are being renewed during building refurbishments. For spaces with large or heavy doors consideration should be given to fitting motorised openers to assist access to those with a disability.

The existing external signage across the UCL estate is generally of a high standard. Within buildings direction signage should indicate the location of nearby learning spaces. If possible prominence should be given on direction signage to spaces that can be used by learners without staff presence (e.g. informal learning spaces, IT cluster spaces, technology touchdown points and common room spaces). The rationale for this is that locating these spaces is 'optional' for learners and evidence suggests that it is only the more prominent examples of these spaces that are used and known to our students (e.g. regular queues for DMS Watson Cluster PCs when other vacant alternatives exist).

As detailed in Section 2.01 signage should exist on, or in the proximity of (preferable), the door or entrance to the learning space indicating both the name of the space and its current availability.

Where possible learning spaces should permit controlled admission of daylight. However priority should always be given to the effectiveness of teaching and learning facilities (e.g. projection or display screens) so effective daylight controls (blinds, shades etc.) need to be provided and the location of such screens needs to take daylight openings into consideration.

In spaces where it is practical it should be possible to open windows for natural ventilation. Reasons this may not be practical include: noisy or polluted external environment; security risk or air conditioning effectiveness.

2.01 Access to spaces



2.02 Signage



2.03 Daylight control and ventilation



2.04 Air handling and/or air conditioning



If the space cannot be adequately naturally ventilated to maintain a comfortable learning environment then a mechanical air handling system and/or air conditioning may be required. Controls for air conditioning are notoriously complex and therefore clear instructions should be produced and positioned alongside the controls. The merits of providing end user controls versus not providing end user controls is included in the guidelines for specific types of learning space.

2.05 Lighting



The lighting design in learning spaces should provide enable presenters and students to see (in the case of learners primarily for note taking) and be seen. Care should be taken over the placement of luminaires in relation to projection and/or writing surfaces. A common mistake is the positioning of a luminaire directly above the projection surface which results in uneven image contrast. Illumination of writing surfaces should be as even/flat as possible to avoid legibility issues. When rooms are being refurbished consideration should be given to the feasibility of relocating inappropriately located luminaires.

Learners using tablet computers for note taking can experience harsh reflections from certain designs of modular recessed fluorescent luminaires due to the horizontal angle that tablets are used at. Therefore care should be taken in selection of luminaires that use indirect illumination and the use of mirrored diffusers should be avoided if possible.

Low energy lamps that require more than 10 seconds to reach maximum brightness are not suitable for usage in learning spaces due to the likely need to regularly change between different lighting states within a taught session.

Luminaires specified for new or refurbished learning spaces should give high frequency (no flicker) light output. General area lighting should have a colour temperature proximate to daylight ($>5000^{\circ}\text{K}$) whereas with breakout or small group learning spaces consideration should be given to having a directional pendant that focuses warmer ($\leq 3200^{\circ}\text{K}$) light on the centre of the discussion area.

Feature lighting is desirable to include within the lighting scheme if the design of the space can be planned to include it. An example of successful feature lighting is the recessed strip lighting featuring the riveted steel beams in the Foster Court Basement PC Cluster.

Reference

"Indirect lighting, while uniform, can also be monotonous, lacking shadow and contrast. Accent lighting on display areas or white boards enlivens a space. Recessed cove lights or pendant mounted directional fluorescents provide accent and task lighting efficiently."

<http://www.designshare.com/Research/Lighting/LightingEnvr1.htm>



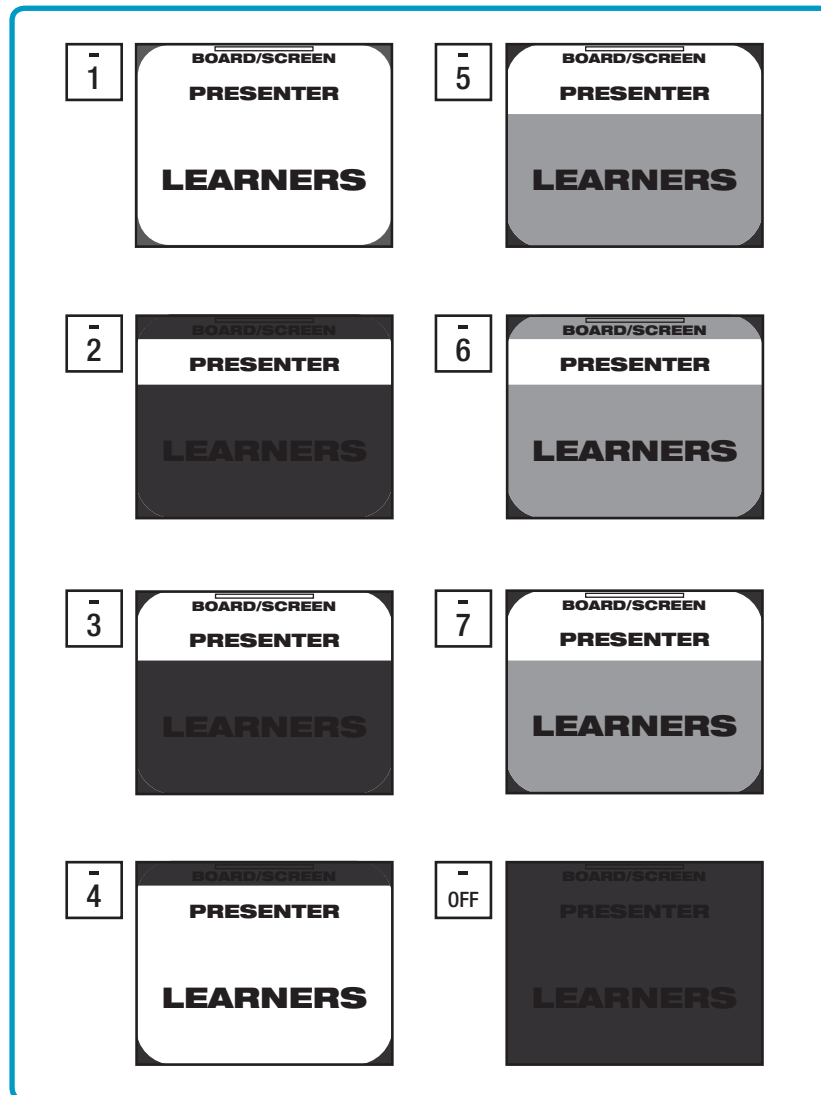
above: recessed feature lighting

Lighting controls should be available in close proximity to the entrance in all learning spaces. For larger spaces secondary controls in proximity to the teaching facilities are required so that the lighting can be optimised by the lecturer for different sections of the session.



above: example of unlabelled lighting control

Ideally a range of lighting levels and dispersement patterns should be selectable by the user of the space. Lighting controls should be clearly labelled, ideally with illustrative lighting pattern diagrams. Selection of switch units with superfluous buttons (more buttons than are needed) should be avoided because this can confuse the end user.



above: example signage for the programmable lighting control shown on the previous page

Controls and switching should permit separate control of the lighting above projection and writing surfaces in relation to the other lighting zones in the space.

The area the presenter typically stands in should be able to lit independently of writing or projection surfaces. With LectureCast present in many spaces it is important that the presenter is well lit even if only low lighting is required on the teaching wall. Without this independent control the presenter either has to risk the projected image being 'washed out' or has to present in near darkness and only a silhouette is captured on the LectureCast camera.

If occupancy sensing is used to avoid energy wastage caution should be employed because a lecture audience or an exam in a computer cluster room can be relatively static. Therefore to avoid inappropriate light switching it is important that the sensor technology employed is capable of detecting static occupancy as well as movement.

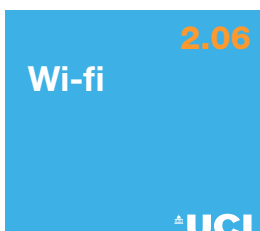
The requirements for emergency lighting in learning spaces is detailed in *UCL Fire Technical Note No: 020*.

Reference

UCL Fire Technical Note
No: 020 is available at:

<http://www.ucl.ac.uk/estates/maintenance/fire/documents/>

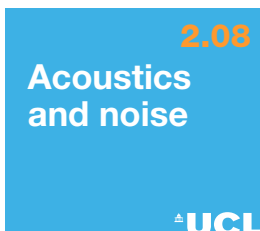
Wi-fi network connectivity should be viewed as a basic requirement of any learning space regardless of whatever other technology is present in the room. When provisioning wi-fi, in addition to ensuring the system design provides guaranteed 100% coverage within the space, the capacity of the system should be designed to accommodate a number of concurrent connections that is 5x the maximum number of people expected to occupy the space at any one time. The logic behind this multiplication factor is that currently many students may bring with them a smartphone, a tablet and a laptop and in future years it is likely that more types of device (e.g. cameras, watches) will seek wi-fi connections.



All teaching spaces should have a working analogue clock visible to the tutor. At present UCL does not have a centrally supported network clock service but it is desirable that a standard for clocks in teaching is specified and implemented. Therefore in new and refurbished spaces provision should be made for a network point in the appropriate clock position.



Acoustic design of the learning space will usually be within the realm of the architect. However relatively minor refurbishments, especially involving removal of any materials with high absorption coefficient (fabrics, ceiling tiles etc.), may have a significant impact on the acoustics of a space.



Also the addition of air handling/conditioning equipment into learning spaces should be planned carefully in order to ensure that the noise rating of the space is within set limits. HVAC plant should either be located away from the learning space or noise control measures put in place.

In the UK no specific standards are defined for the acoustic performance of University learning spaces. However it is useful to refer to the Department for Education's "Building Bulletin 93: Acoustic design in schools" document. Although this document is in the process of being superseded it is currently recommended by the DfE that it continues to be used for guidance.

In BB93 the A weighted sound pressure values specified for the upper limits for indoor ambient noise levels for different types of learning space are:

Type of space	Upper limit for the indoor ambient noise level $L_{Aeq,30mins}$ dB
Classrooms	35 (40 for refurbishments)
Lecture Theatres	35 (40 for refurbishments)
ICT Rooms (PC Cluster rooms)	40 (45 for refurbishments)

Reference

"Part E does not apply to nursery schools which are not part of a school, sixth form colleges which have not been established as schools, and Universities or Colleges of Further and Higher Education. However, many of the acoustic specifications are desirable and can be used as a guide to the design of these buildings."

<https://www.education.gov.uk/publications/standard/publicationDetail/Page1/BB93>

Whilst it may not realistic for the internal UCL teams to make measurements of ambient noise levels these figures are useful as

a standard to pass onto architects and designers of our learning spaces.

On a practical level sources of noise such as metal waste/recycling bins and vending machines should not be located immediately outside the entrances to learning spaces. For larger learning spaces it is desirable to have entrances that comprise of two sets of part-glazed doors with a sound suppressing lobby in between.

In teaching spaces such as lecture theatres the reverberation time needs particular attention during the design stage (for new builds or for major refurbishments):

Type of space	Performance standards for reverberation time T_{mf} seconds
Classrooms	≤ 0.8 (≤ 1.0 for refurbishments)
Lecture Theatres	≤ 1.0 (≤ 1.0 for refurbishments)
ICT Rooms (PC Cluster rooms)	≤ 0.8 (≤ 1.0 for refurbishments)

2.09 Assistive listening systems

UCL

Hearing impaired students can benefit greatly from clearer and more intelligible audio if the learning space they are in has an assistive listening system (ALS) installed. There are a variety of different types of ALS:

- Infrared (IR) systems – where the user is issued with a IR receiver with its own earpieces and there has to be an unobstructed line-of-sight between the IR transmitter and the IR receiver worn by the user. Drawbacks include the institution having to issue receivers, maintaining the hygiene of the receivers and the fact that hear impaired users are differentiated from their peers by having to wear an obvious device.
- Frequency Modulation (FM) systems – these use licenced FM bands and require the user to wear a specific receiver with its own earpieces. Drawbacks include the costs of licencing, the institution having to issue receivers, maintaining the hygiene of the receivers and the fact that hear impaired users are differentiated from their peers by having to wear an obvious device.
- Induction Loop systems – these work by sending an input signal to a loop driver to produce an electromagnetic field from a number of wires placed around the space (usually under the carpet). Those with hearing impairments then move a switch on their hearing aid to the 'T' position which makes use of a telecoil (present in 95% of hearing aids) to pick up the output signal. Whilst these system are more disruptive, and thus costly, to install they have many advantages over the other two system types. These include the fact that the hearing impaired person is using their own hearing aid which is likely to have a frequency response tailored to the specific nature of their impairment.

An important element regardless of which transmission method is used is the quality and appropriateness of the input microphone.

The selection of appropriate microphone types is covered in Section 3.08.

Every space that has an induction loop installed should have the international standard signage displayed so that users are aware of its existence.

At present induction loop systems are only installed in the larger lecture theatres at UCL. Going forward serious consideration should be given to installing a loop system into any new-build or refurbishment of medium to large classrooms or teaching cluster rooms where audio reinforcement is also being installed as these spaces can be equally challenging for the hearing impaired.

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Reference



The international standard signage to indicate the existence of an audio induction loop.

Section 3: AV Facilities and Teaching Station

The audio visual facilities within learning spaces will need to vary dependant upon the intended function, size and physical layout of the space. It is desirable to standardise the user interface and operation method of audio visual facilities across all spaces so that teaching staff can gain confidence in how to use the facilities and know that once they've mastered the facilities in one space that this is transferable across spaces.

Detailed technical specification of the equipment that makes up the typical audio visual provision and its configuration within different categories of learning space is included in Appendix 1 but what follows are over-arching principles.

All controls and interfaces for the audio visual facilities within a learning space should ideally be located on a single 'Teaching Station'. This is a single piece of furniture that provides working surfaces and secure accommodation for equipment.

The siting of the teaching station within a learning space should be carefully considered to take into account these factors:

- the lecturer should be able to face the students when operating the facilities and the facilities themselves should not inhibit the lecturer's view of the students
- the teaching station should not be located so that its use would inhibit the students' view of presentation display surfaces
- the siting of the teaching station should not inhibit ingress or egress of users to the space

The design of the teaching station should enable its use by people of different heights and if there is a horizontal writing/presentation surface provided (e.g. visualiser) then this surface should ideally be height adjustable to facilitate comfortable usage when standing for users of differing heights.

The teaching station should contain an equipment cabinet to accommodate standard 19" rack-mountable equipment. Security bolts shall be used when mounting equipment in the cabinet and any unused rack spaces should be covered with blanking panels in order to prevent unauthorised access to the rear of equipment or the storage of inappropriate items within the equipment cabinet.

Controls and configurations that are not appropriate for end users (e.g. power amplifier output levels, audio loop configuration, radio microphone channel setting) should be concealed behind a lockable door on the equipment cabinet (unless this equipment is located in another secure location).

All the key functionality of the equipment within the teaching station should be controllable from a single touch sensitive control panel. The rationale for this approach is that it permits a variety of equipment types to be controlled from a standardised user interface. It also does away with the need to provide tethered infrared remote controls for certain equipment.

3.01 Audio visual facilities



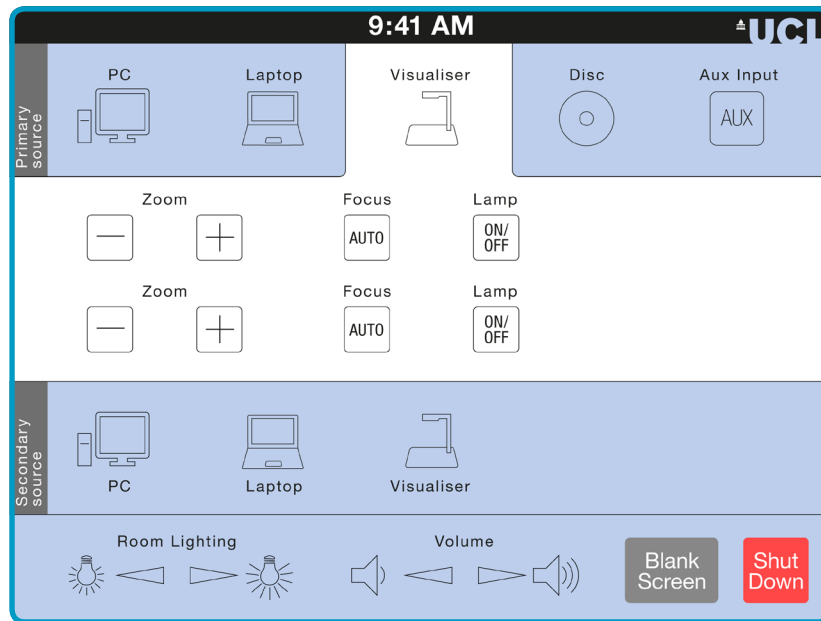
3.02 Teaching Station design



3.03 Controls for the Teaching Station

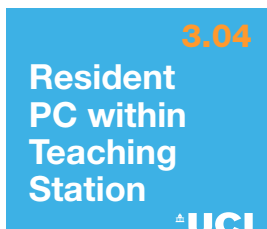


The interface design should follow best practice for touch controlled devices (e.g. smartphones).



above: example control panel design

A 'Blank Screen'/'Show Screen' control should be provided to blank the main projection/display. This control should not blank the image on the teacher's display so that it is possible to use the facility to prepare upcoming materials out of view of the class.



All learning spaces equipped with a teaching station should contain a fixed personal computer configured to the UCL standard for teaching machines.

The PC should have a wired keyboard and mouse to avoid issues of depleted batteries in wireless units.

The aspect ratio of the projector image, or large screen displays if these are present, should be 16:10. The monitor for the PC should have an aspect ratio that matches this aspect ratio.

The resolution of the graphic output of the computer should match the native resolution of both the computer monitor and the projector image/ large screen displays. This should ensure an equally sharp image on both the projected image and the monitor.

Functionality to allow 'side-by-side' simultaneous display of two sources (e.g. computer feed and visualiser feed) are of limited value because of the resultant portrait orientation of each image. If simultaneous display of two sources is required in a particular space then the preferable solution, in spaces large enough to permit it, is to provide two screens side-by-side.

The energy management and updater options on the fixed personal computers in learning spaces should be configured to:

- Not activate a screen saver
- Not auto log-out after a period of activity
- Not display on-screen notifications about system or application updates available

In addition to the resident PC there should be the facility to connect a portable computer, tablet device or video device to the teaching station for display onto the presentation surface(s).

Connections offered should include:

- VGA
- HDMI
- 3.5mm jack plug audio input for laptop audio
- Ethernet RJ45 network connections

Suitable length VGA and HDMI male-to-male leads should be securely tethered to the teaching station as should the 3.5mm stereo jack plug audio lead.

The logic for the provision of the RJ45 network connection is for when connectivity resilience is paramount e.g. video conferencing with external industrial partner. Ideally the network socket should be patched to a network switch supporting DHCP or if this is not possible then information about an assigned IP, subnet and router addresses should be attached to the console for those technically proficient to utilise this information.

Visualisers, also known as document cameras, can be used in the following ways:

- to project transparency slides that were previously used with a Overhead Projector
- to project 35mm slides via the slide carrier integrated into the lens mount of some visualisers
- to display documents placed on the working surface
- to display objects placed on the working surface
- to use the working surface as a horizontal writing surface

However it has to be recognised that writing on a horizontal surface at approximately waist height is both challenging from an ergonomic perspective and a very different activity from the traditional skill, honed over years by many staff, of writing large and legibly on a vertical writing surface.

Visualisers have the benefit of being relatively intuitive to understand and not requiring the operator to learn any software prior to use.

One aspect of visualisers that can be constraining when using them as the primary writing surface is the width of the base board working area. The dimensions of this working area are a result of the historic transition from OHPs and the need to be able to display a sheet of A4 paper in either the landscape or portrait orientation.

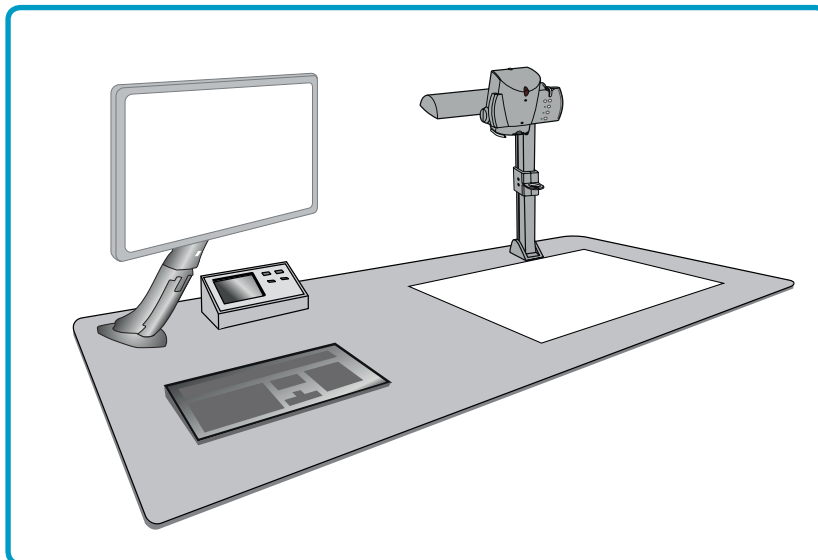
To avoid this constraint and to maximise the visualisers usable width as a writing surface consideration should be given to fitting units without a baseboard, or recessing the visualiser baseboard into the worktop, so that the full width of the camera capture area can be utilised for writing either by the use of an appropriately sized dry-wipe write-on surface fixed on the worksurface or A3 paper.

3.05
Support
for mobile
devices

UCL

3.06
Visualiser

UCL



above: illustration of visualiser with recessed into worktop

Video playback

3.07

UCL

Expectations of both students and staff are that regular use of video materials will feature in many teaching interventions. Increasingly replay of video material will be accomplished via streaming, stored content on USB storage connected to the PC, or a portable device connected to the teaching station.

Certain video material may however only be practically or legally available on physical optical media. Video playback facilities are therefore justified within the teaching station. This is accomplished through a optical disc player for 12cm discs with the following compatibility:

- BluRay (Region B)
- DVD (Region 0 and Region 2)
- DVD+R finalised discs
- DVD-R finalised discs
- CD
- CDR finalised discs
- CD photodisc

Optical disc players capable of replaying DVD and/or BluRay from other geographic regions are deployed where there is a specific request from the users of a particular space. However it should be noted that it is often problematic to obtain multi-region players through manufacturer's official supply channels and therefore the practice of installing these players is intentionally minimised in order to ensure business continuity by using players with suitable warranty and after-sales service.

There is no longer any justification for providing tape based video replay equipment.

Microphones in teaching spaces provide signal input to some or all of the following:

- Assistive listening system e.g. induction loop (see Section 2.09)
- Vocal sound reinforcement
- LectureCast (see Section 3.12)

If any of the above three systems are present in a teaching space then a suitable microphone system should be deployed. The most suitable type of microphone system to deploy in a particular space will depend upon the following variables:

- the size of the space
- the ceiling height above the 'teaching zone'
- the opportunity to install microphone cables running from the teaching station to ceiling locations

Different microphone solutions for different categories of spaces are detailed in the relevant sections of these guidelines.

The selection of audio amplifiers and loudspeaker systems should take into account the size, acoustic properties and intended usage of a space. Appropriate placement of loudspeakers is as important as the correct choice of loudspeaker. As a general principle loudspeakers should not be located in room corners as this negatively impacts the amount of direct vs. reflected sound the user will experience.

Another general principle is that it is better to have multiple loudspeakers working at lower volumes than it is to have only a single stereo pair at the front having to be driven loud.

Audio amplifiers for learning spaces should be specified such that in normal use they are never being used at beyond 70% power to ensure there is sufficient 'clean' headroom before distortion or clipping.

Different types of amplifier/loudspeaker systems exist:

- Stereo pair (typically on the teaching wall) – the simplest system comprising of a two channel power amplifier and a pair of individually connected loudspeakers. This solution is only suitable for small spaces but can offer better stereo imaging and high audio quality.
- Multi-channel speaker system – this will require either a four or six channel amplifier or a number of separate power amplifiers. In larger spaces this solution can have the benefit of being able to apply a delay to the speakers further away from the presenter to compensate for the time the direct sound from the presenter (or more precisely the loudspeakers at the front) takes to reach the rear of the space. In reality no teaching spaces are likely to need this type treatment. However another advantage of a multi-channel system is that the sound levels in different parts of the space can be easily adjusted.
- Constant-voltage speaker system – also known as a 100V Line system. By using step up and step down transformers

3.08 Microphones



3.09 Amplifiers and loudspeakers



(usually built into the audio equipment) longer cable runs and easier multiple loudspeaker installation designs can be achieved. The drawbacks of this type of system include potential degradation of sound quality if the transformers are not of suitable quality and the inability to adjust the relative sound levels between the different loudspeakers (although some can be adjusted at time of installation by using different transformer tapings).

- **Single source line array** – this type of loudspeaker system comprises multiple loudspeakers in an array of enclosures placed near the front of the space. Each element of the enclosure is designed to give a very specific dispersement pattern and through the use of digital sound processing a much more even front-to-back dispersement can be achieved i.e. listeners at the rear of the space will hear sound sources at the same sound level as those at the front. This type of loudspeaker system requires specialist design and installation services to ensure optimal performance in the specific space.



above: a line array loudspeaker system

Regardless of the amplifier/loudspeaker technology deployed within a particular learning space the configuration controls (e.g. power amplifier output levels) should be inaccessible to end users with only the master volume control via the teaching station control panel available.

Where it is most appropriate to utilise a data/video projector as the primary display technology care should be taken to ensure that:

- for ceiling-mounted projectors that the stability of the image will not be effected by footfall in the room above nor its proximity to other services such as HVAC
- for ceiling-mounted projectors that the filter can be periodically cleaned, ideally without the need for specialist access equipment
- **for wall-mounted projectors** that the stability of the wall is sufficient to render a stable image that will not be effected by the closure of nearby doors etc.

In spaces where there is not space to accommodate sliding ‘column’ whiteboards, nor separate projection screen and a whiteboard alongside each other, a hybrid projection/dry-erase board should be used. In these instances the projector used should be of the Ultra Short Throw (UST) type. UST projectors, whilst limited in terms of maximum image size, have the benefit of not suffering from a ‘hot spot’ reflecting back to users. In smaller learning spaces UST projectors also have the advantage that the instructor will not obstruct the projector beam if standing in front of the board nor be dazzled by it.

Below is a table showing the advantages/disadvantages of different learning space display solutions:

Solution	Use writing surface and display projected image concurrently	Ease of alternating from written display to projected image (excluding use of visualiser)	Annotate on projected image	Future possibility to capture written board material into LectureCast
Standard throw projector with pull down screen in front of shiny whiteboard	No (unless additional whiteboards in space)	Need to master the technique for operating the retractable mechanism but can be done without erasing written material	Not possible	Not possible
Ultra-short throw projector with hybrid projection/dry erase board	No (unless additional whiteboards in space)	Have to erase what is written on the board first	Possible	Possible via interactive add-on for the projector
Standard throw projector onto screen behind columns-mounted whiteboards	No (boards are either in front of projection screen or out of direct view)	Easy to raise/lower boards	Not possible	Not possible

Security measures should be in place to protect the projector such as an anti-tamper alarm or anti-theft bolt fixings.

3.10 Projection specifications



Reference

Association of Educational
Technology Managers
(Australia) "AETM Design
Guidelines for Tertiary
Teaching Spaces: 2nd
Edition"
[http://www.aetm.
org/uploads/media/
AETM_Audio_Visual
Design_Guidelines_2nd_
Edition.PDF](http://www.aetm.org/uploads/media/AETM_Audio_Visual_Design_Guidelines_2nd_Edition.PDF)

The dimensions of the projected image in learning spaces should be proportional to the viewing distance. The specification given by the AETM guidelines is that the furthest viewing position should be no more than 5.3 times the height of the display and this forms good general guidance across a range of contexts.

In reality the maximum acceptable viewing distance (or conversely the minimum image size) is dependent on the type of material being shown. Giving a demonstration of how to use a software application such as Excel will require students to be able to see much smaller objects and finer detail.

One alternative method for calculating the minimum dimensions for a display within a teaching space is based upon this logic – the '4:6:8 rule'. According to this rule the minimum image height should equal the maximum viewing distance divided by a factor of:

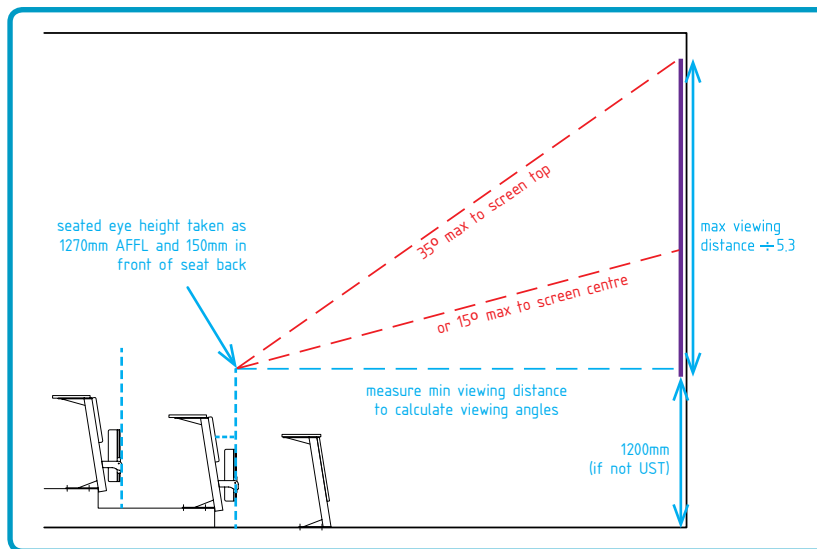
- 4 for Excel documents or items for inspection
- 6 for PowerPoint, graphs or typical presentation material
- 8 for video viewing

For the sake of simplicity it should be assumed that any display being installed in a teaching computer cluster room will be used for detailed viewing and therefore priority should be given to either increasing the display size or reducing viewing distances by the use of multiple or repeater screens.

The type of projector, standard throw v.s. ultra short throw, should be dictated by the display requirements (i.e. minimum dimensions proportional to the maximum viewing distance as per the 5.3 rule above) and the installation/mounting conditions in the location (e.g. avoid UST if a stud wall is not sufficiently sturdy).

In terms of the position of the projection surface most other guidelines specify that the base of the displayed image should be 1200mm from the floor. Whilst this is undisputed for standard throw projectors this height should be reduced to 1000mm from the floor when an ultra-short throw projector is being specified. The rationale for the different floor to screen heights is that ultra-short throw projectors may be retrospectively fitted with interactive capabilities and a board mounted at 1200mm from floor is typically too high for use as an interactive writing surface.

Calculations should also be made to ensure that the viewing angles for those nearest the screen. 35° to the screen top or 15° to the screen centre are the maximum viewing angles recommended in order to avoid neck strain for viewers.



above: illustration of maximum screen viewing angles

The table below gives example screen sizes for use with a UST projector (based upon NEC UM330W):

board/screen size	image size (16:10)	image base from floor	max distance of viewer	lens/board distance
1400 1000	1400 875	1000	4637	160
1800 1200	1800 1125	1000	5960	301
2400 1200	1920 1200	1000	6360	347
2400 1500	2380*	1488	7886	512

*max image size with NEC UM330W

Reference

NEC Projector
Image Calculator

<http://www.nec-display-solutions.com/p/uk/gb/products/wizard/imagecalculator.xhtml>

The table below gives example screen sizes for use with a standard throw projector (based upon NEC P350W):

image/screen size (16:10)	image base from floor	max distance of viewer	lens/board distance (zoom limits)
1800 1125	1200	5962	2340—3954
2000 1250	1200	6625	2600—4394
2400 1500	1200	6360	3120—5170
3000 1875	1200	9937	3900—6594
4000 2500	1200	13250	5200—8794
6460*	4037	21396	8398—14206

*max image size with NEC P350W

In certain situations large LCD/LED flat panel displays may either be more suitable as the primary display or used in conjunction with the data/video projector to provide secondary displays for those seating positions that cannot easily view the main display.

These displays should be mounted in such a way that their connections and power supply are inaccessible to end users. The aspect ratio and display resolution of flat panel displays should match the aspect ratio of the computer monitor and projector image (if a projector is included in the space).

3.11 Large format display panels

UCL

Display panels with a soft screen surface should be avoided because of the risk of accidental or intentional damage.

3.12 LectureCast



LectureCast is the UCL lecture capture and replay service. If the space is equipped for LectureCast there will be a number of considerations needed to ensure that recordings made in the space are of maximal use to students. These may include but are not limited to:

- signage to indicate the presence of LectureCast technology and provide basic guidance on how to utilise it
- a suitable microphone setup (as described in Section 3.08)
- a fixed camera that covers a defined presentation area
- a status indicator to show when a session is being recorded with confirmation that a suitable audio signal is working and being captured
- facility to initiate an impromptu recording session

3.13 Telephone



All teaching spaces should have a working telephone in the proximity of the teaching station. The telephone should ideally be wall mounted (to avoid taking up worktop space on the teaching station) and be able to be used in reach of the teaching station controls (so a user can be talked through the process of how to use the facility if they call the ISD Service Desk for help). The telephone should be able to receive incoming calls but should display this via a light rather than an audible ringer.

3.14 Instructions for audio visual facilities



In all learning spaces with audio visual facilities there should be a set of instructions provided. This should ideally be in the format of a single laminated A4 card attached to the teaching station via a chain. The instruction sheet should be tailored to the specific equipment in the space.

An example of an instruction sheet is contained in Appendix 4.

The telephone number of the support desk should prominently feature on the instruction card.

In future instructions can also be provided via the teaching station touch panel but it should be recognised that if a user is experiencing problems operating the equipment via the touch panel controls then providing further information through this interface may not be the most helpful way to support the user.

3.15 Commissioning the facilities



When new facilities are installed into a learning space by external suppliers there should be a documented commissioning and handover/acceptance process.

All functionality of the installation should be confirmed as working and the compliance of the installation with these guidelines checked by a Learning & Teaching Spaces representative and/or an E-Learning Environments representative. If elements of the installation fail these checks then a repeat check scheduled to follow the required remedial works.



Section 4: Small Classrooms (< 10 capacity)

These spaces are defined as having movable furniture, flat floors and range in capacity from accommodating 4 students up to 9 students.

Small classrooms are used by staff and students on more specialised modules or where a larger cohort is taught in subdivided groups. They are also commonly used for tutorial and post-graduate supervision meetings. Students will also utilise unoccupied small classrooms to practice group presentations etc.

4.01

The purpose of a small classroom

UCL

Space is a major constraining factor when specifying the equipment for small classrooms. Whilst across all other types of learning space there is an aim to keep the user experience consistent so that staff become confident how to operate the facilities across the whole estate this is not feasible for the small classrooms on the grounds of space. It is also difficult to justify the higher cost of the equipment types used in larger rooms (e.g. touch control panels) for small classrooms when lower budget systems work adequately in this type of space.

4.02

Technology in small classrooms

UCL

Voice reinforcement and assisted listening systems (induction loop system) are not justifiable within small classrooms. If a student or staff member identifies the need for this type of system then there are portable systems available with UCL that will work well in this size of space. Loudspeakers and amplifier should be present for programme sound (the replay of sound from recorded and remote sources). Lecturecast is unlikely to be installed in small classrooms as the sessions run should be more interactive than a typical lecture and thus recordings of such sessions are of limited value unless all participants are recorded and this gives rise to various consent issues.

It is acceptable to omit dedicated video playback facilities as most optical video discs can be replayed via the computer resident in the room.

The teaching equipment in small classrooms should not intrude into the limited space available and therefore it is recommended that wall-mounted equipment and housings are utilised.

By the nature of the furniture being movable there will be a degree of flexibility in the layout of the classrooms. However this does not mean that specific design attention shouldn't be paid to the potential layouts achievable with suitable furniture. Guidance illustrations of exemplar layouts with the furniture supplied in the space should be attached to the wall of the space and made available on the room bookings website. Additionally an inventory of the furniture provided in the room should be included so users are aware of what should be present and how to report missing items if appropriate.

4.03

Layout of small classrooms

UCL

Small classrooms may not have enough space to allocate a 'Teaching Wall' and therefore it may be appropriate the use separate walls for electronic display and dry-erase writing surfaces. The layout

of the classroom should be such that it is possible to freely walk around the class without disturbing students already seated.

4.05
**Projection/
writing
in small
classrooms**
UCL

In most small classrooms there is not sufficient space for any type installed data projector. Therefore the recommended electronic display technology for small classrooms is the large format LCD display.

A vitreous enamel dry-erase whiteboard should be provided in small classrooms.

Section 5: Classrooms

These spaces are defined as having movable furniture, flat floors and range in capacity from accommodating 10 students up to 80 students.

Classrooms are intended to support a different teaching methodology to that employed in lecture theatres. The following teaching and learning methods are suited for classroom spaces:

- Inquiry-based learning
- Problem-based learning
- Discussion-based learning
- Student-led interactive learning
- Simulation-based learning

The technology within classrooms should closely resemble, but be more limited in capacity, that installed in lecture theatres with common controls interfaces and layouts. Loudspeakers and amplifier should be present for programme sound (the replay of sound from recorded and remote sources). Lecturecast is also less likely to be installed in classrooms as the sessions run should be more interactive than a typical lecture and thus recordings of such sessions are of limited value unless all participants are recorded and this gives rise to various consent issues.

By the nature of the furniture being movable there will be a degree of flexibility in the layout of the classrooms. However this does not mean that specific design attention shouldn't be paid to the potential layouts achievable with suitable furniture. Guidance illustrations of exemplar layouts with the furniture supplied in the space should be attached to the wall of the space and made available on the room bookings website. Additionally an inventory of the furniture provided in the room should be included so users are aware of what should be present and how to report missing items if appropriate.

Most classrooms will have a primary focus direction where it makes sense to concentrate the teaching facilities and displays. This is often referred to as the 'Teaching Wall'. The layout of the classroom should be such that it is possible to freely walk around the class without disturbing students already seated.

Classrooms are typically not large enough to warrant provision of voice reinforcement facilities or assistive listening systems. However LectureCast has already been installed in a small number of classrooms and it is likely that in the future there will be more installations into classrooms. This gives rise to the need for microphones in certain classrooms.

Where there is the need for microphones in a classroom only for LectureCast purposes the ideal solution is that array microphones with 'corridor characteristic' pickup patterns are installed on the ceiling at 2–3 metre intervals. Typically this will be two microphones positioned at one third and two third positions across the width of the 'teaching zone'. The microphones should

5.01 The purpose of a classroom

UCL

5.02 Technology in classrooms

UCL

5.03 Layout of classrooms

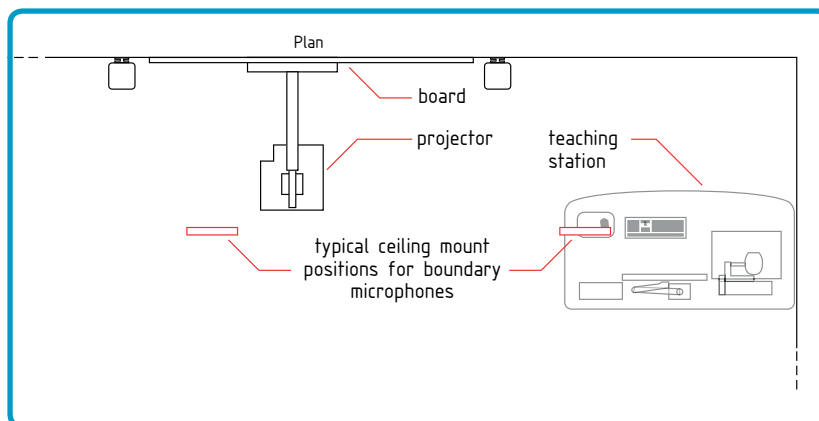
UCL

5.04 Microphones in classrooms

UCL

Suitable microphone models are specified in Appendix 3: UCL standardised equipment list

be positioned between 1000mm and 1500mm from the wall/board surface so that the pickup area is biased in favour of the presenter rather than the audience. These microphones should have balanced signal cables to minimise the possibility of cable induced noise and should be phantom powered (48V) by the equipment within the rack. Suitable microphones are available in white finish to minimise their visual conspicuity.



above: illustration of typical positions for boundary microphones

The primary advantage of this microphone solution is that it does not require the user to understand how to operate any microphone and is not dependent upon either a rechargeable battery being charged or non-depleted disposable batteries being present.

Installation of gooseneck microphones on the teaching station should not be necessary and should be avoided as they encourage static lecturing styles and potentially cause uneven sound levels if the lecturer does move in and out of its pickup zone.

It is conceivable that there may be classrooms where microphones are required but that it is not practicable to install ceiling mounted boundary microphones. In these circumstances it would be advisable to install wearable microphones as per large lecture theatres (see Section 7.06).

In many classrooms there is only sufficient space on the teaching wall for a single screen or writing board. Previously the solution of a retractable, pull-down, fabric projection screen in front of a shiny dry-erase whiteboard had been commonly utilised.

This solution had a number of drawbacks:

- Projection surface easily damaged by accidentally being written on with dry-erase pen
- Retraction mechanism easily damaged through over extension
- Downtime of room due to need to regularly replace damaged screens

In light of this an improved solution was developed and this now forms the standard specification used for classrooms. The typical layout of this standard classroom is shown in Appendix 1

If the room size will not permit use of separate surfaces for writing and projection then a combined function surface should be used. A semi-matt vitreous enamel board should be used for this purpose

and a number of manufacturers make boards to this specification. In these circumstances an Ultra-Short Throw (UST) data projector should be mounted above the board.

The size of the combined function board will typically be 1920mm x 1200mm mounted 1000mm from the floor. If space, and height permits then a larger board, up to the maximum 2400mm x 1500mm supported by the UST projector, should be specified.

If the room size will permit then a separate 'shiny' dry-erase whiteboard should be installed alongside vitreous enamel projection surface (which has the UST projector above). Sight lines of both boards should be considered and neither should be given undue prominence through central placement of the other.

UST projectors require a greater amount of 'headroom' above the board to accommodate the projector mounting bracket. If there is not the ceiling height available to use a UST projector then a ceiling mounted standard throw projector can be used with a matt projection board (only in rooms where alternative 'shiny' boards can be provided alongside, on alternative wall or via column boards. The matt projection surface should display a label notifying users that it is not a writing surface. The specification of this projection surface should be such that if it is accidentally written on then it will not be damaged and the marks can be cleaned off via the use of detergent or solvent agents.



Section 6: Small Lecture Theatres (< 50 capacity)

UCL is atypical in the sector in that it has seven smaller capacity, i.e. less than 50 people, teaching spaces with fixed position seating. These spaces are booked as 'Lecture Theatres' but it can be assumed that a wider range of teaching methodologies takes place in them than what would normally be categorised as 'lecturing'.

For examples of teaching methodologies beyond lecturing that may take place in these small lecture theatres please refer to Section 5.01.

The technology within small lecture theatres should closely resemble that installed in larger lecture theatres with common controls interfaces and layouts. Audio reinforcement and assisted listening systems (induction loop systems) are unlikely to be needed or installed. Speakers and amplifier should be present for programme sound. Lecturecast is not currently installed in any of the sub-50 capacity lecture theatres but as LectureCast is rolled out further it is likely that some of these small lecture theatres will have the system installed. When this arises the microphone solution specified for classroom (Section 5.04) would be recommended.

By the nature of the furniture being fixed there is less flexibility in the layout of these small lecture theatres. The positioning of the teaching station is critical to ensure the lecturer can face the students whilst operating the teaching equipment and not be obstructing the student's view of presented materials. If there is insufficient space to accommodate the teaching station facing the students due to lack of available space the result may be that the teaching station needs to be positioned perpendicular to the student benching/seating.

If space permits then the solution of column-mounted whiteboard panels in front of a dedicated projection screen should be utilised. If there is not adequate space for this solution then the same logic for selecting the projection/writing surfaces in classrooms (Section 5.04) should be employed.

.....

6.01

**The purpose
of small
lecture
theatres**

UCL

6.02

**Technology
in small
lecture
theatres**

UCL

6.03

**Layout of
small lecture
theatres**

UCL

6.04

**Projection/
writing in
small lecture
theatres**

UCL

Section 7: Large Lecture Theatres

These spaces are defined as having fixed seating and vary greatly in capacity. Larger examples often have raked floors to improve the view and audibility for students.

There have been significant shifts in what is recognised as good teaching practice and nowhere is there more controversy and resistance to change than in the conception of the large lecture. However a number of contributory factors have made many academics question the validity of verbally delivering content to hundreds of students packed into passive rows. These factors include:

- the technological alternative methods for ‘conveying’ content (VLE, podcasts, ‘flipping the lecture’, personal lecturecasting)
- increased expectation from fee-paying students that their learning experience will be engaging and not passive
- greater student numbers without corresponding increase in resources and increasing capacity pressures put upon University estate
- abundant research published on more effective methods of teaching
- technology such as Electronic Voting Systems that permit the large scale face-to-face sessions to be much more interactive and discursive therefore exposing the comparatively limited effectiveness of didactic lecturing and the inherent problems of using a traditional lecture theatre for any different mode of teaching that diverges from the one for which it was designed
- ubiquity of web connected mobile devices enables learners to simultaneously cross-reference or contextualise what the lecturer is presenting resulting in a change of the expertise dynamic and increased tendency to encourage discussion within the session
- ability for students to attend the live session virtually by means of synchronous online collaboration tools or live lecturecast streaming
- ability for students to ‘skip’ the live session and ‘catch up’ via the lecturecast recording – after all if the lecture is a passive experience for the student then passively watching a recording would an equal value experience

This questioning of the role of the traditional lecture would need to inform the design of any new teaching space developments. However where an existing lecture theatre is being refurbished there may also be scope to consider adjustments that would better future-proof the space.

7.01
**The purpose
of a large
lecture
theatre**
UCL

Seating 7.02



Reference

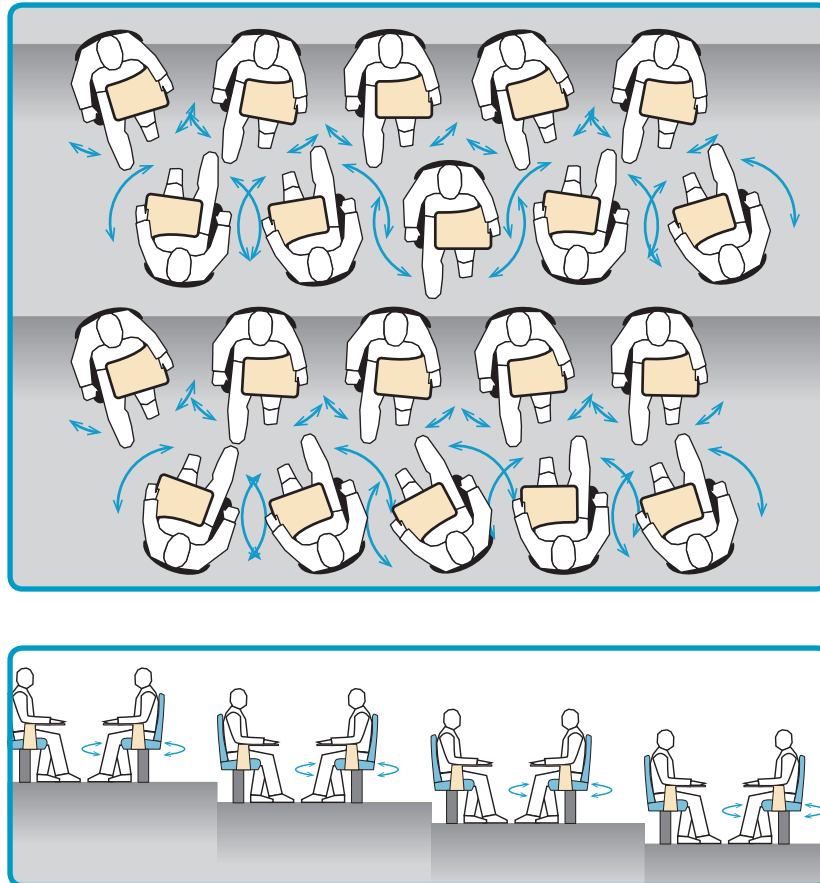
Iowa State University case study:

<http://net.educause.edu/ir/library/pdf/P7102cs9.pdf>

The traditional layout of the audience seating in large lecture theatres is long, single rows with one row of seats per tier in raked spaces. Rows are either straight or curved with the intention of keeping the individual seats orientated to the teaching focus of the space. Seats either have a fold-out note-taking surface or are behind shallow fixed desking.

In future consideration should be given to alternative layouts.

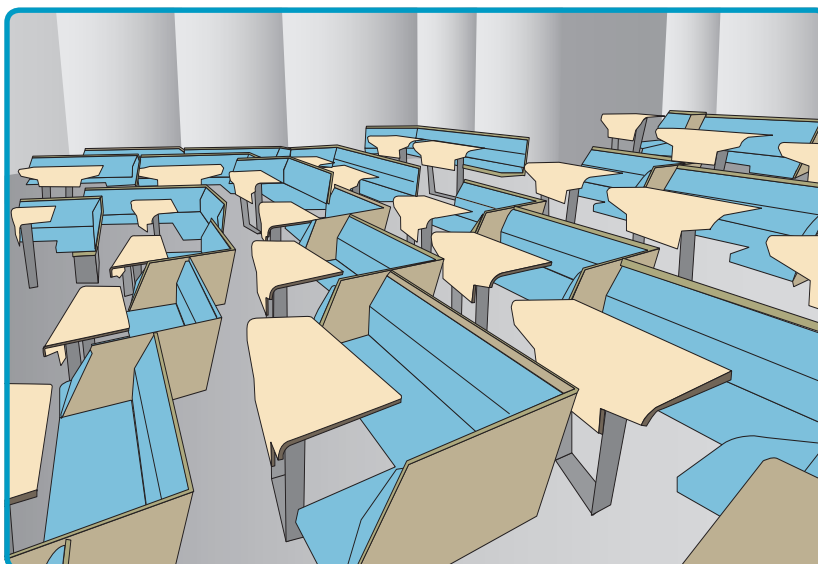
One layout idea that has been seen at other institutions (Exeter and Iowa State) is to provide alternate rows of seating that can be rotated to facilitate the small group discussion that is now common in sessions that are seeking to be more active and engaging.



above: example lecture theatre layout with rotating seating

If this type of seating is to be included specific attention needs to be given to the relative positioning of the seats. Errors that can be made include positioning both front and rear seats on a particular tier in direct alignment obscuring the view of the rear seat occupant. Another error, that has been seen in a lecture theatre of this design at another institution, is insufficient space between the two rows on the same tier which results in occupants being uncomfortably close when in discussion mode.

Another, more interesting design, goes one step further and gets the students to sit in groups from the outset. This design, seen at Loughborough University, also has the benefit of giving each group a large enough shared table space that small scale group practical task and/or object-based learning can be practised.



above: example lecture theatre layout to support small group work

Even in lecture theatres where seating is laid out in conventional rows, consideration should be given to improving sight lines by staggering the seat positions between rows.

Lecture theatre seating should be of high quality and be comfortable for extended occupancy periods. Upholstery should be chosen for durability and longevity.

In all lecture theatres, with the assumption that all lecture theatres will be wheelchair-accessible, there should be provision for wheelchair users to partake in the lecture whilst in their chair. The number of these spaces should be proportionate to the total number of seating positions.

Fire and emergency guidance relating to the design of fixed lecture theatre seating is given in the UCL Fire Safety Technical Notes & Mandatory Instructions:

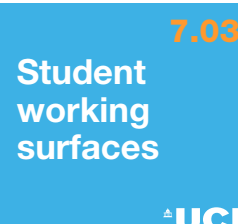
<http://www.ucl.ac.uk/estates/maintenance/fire/documents/>

Each student seat should be provided with a horizontal surface suitable for use when taking notes or using a small portable electronic device.

If the working surface is to be provided via the use of a fold out attachment to the seat then these should either be left/right swappable by the user or a 10% ratio of seats are to be provided with left-handed surfaces. The distribution of these 10% of surfaces should be designed such that their location is clear to users, for example the left-hand end of rows would be a suitable location.

Working surfaces should not have any raised lip around their edge, should be made/covered in a material that provides a non-slip surface but that is not overly textured.

Working surfaces should have minimum dimensions of 300mm by 300mm.



7.04 IT and power provision for students



IT provision for students in lecture theatres is minimal but as per Section 2.06 the Wi-Fi infrastructure in the space should be designed to accommodate a number of concurrent connections of 5x the maximum number of people expected to occupy the space at any one time.

Students have specified that they value access to power sockets in learning spaces. However as mobile devices have ever-increasing battery capacities, currently many devices have all-day batteries, it is uneconomic and unjustifiable to specify power outlets to every seating position.

A compromise arrangement is to fit power provision to only a proportion of the seat positions. A recommended approach is to fit power provision to only the first two rows of seating in lecture theatres as these are typically the least favoured by students. Selecting these rows has the dual benefit of ensuring that those who need the sockets can get to them as well as generally encouraging the students to sit closer to the lecturer.

To reduce the cost and complexity it is advisable to explore with the electrical contractor the possibility of installing an A3 20A radial circuit for these power outlets. The '*Requirements for Electrical Installations IEE Wiring Regulations – BS 7671:2008*' have previously limited the areas this type of circuit can be installed within to <50m² but the July 2008 Corrigendum to the Seventeenth Edition demotes this restriction to 'historical' and therefore provided volt drop, disconnection time and likely load considerations are met there are no limits to floor area or socket numbers.

In addition to provision of BS1363 power outlets it is desirable to provide inbuilt USB charging facilities for students using tablets and other small mobile devices that can be charged via USB. Typically small mobile devices require a 0.5A charge current but tablet computers such as Apple's iPad require a 2.1A charge current.

A number of manufacturers offer recessed socket outlet panels that can be fitted into desking. Caution should be used in assessing the merits of these systems and special consideration given to the additional risks posed by sockets mounted in the horizontal plane where there is the potential of accidentally spilt fluids.

7.05 Teaching Stations in large lecture theatres



Teaching Stations in larger lecture theatres should be operationally consistent with those in classrooms but will have additional functionality.

7.06 Microphones in large lecture theatres



Large lecture theatres typically have voice reinforcement, assistive listening and lecture capture systems and therefore they also have the requirement for high quality voice pickup by microphone.

The high ceiling height in most lecture theatres precludes the use of ceiling mounted array microphones and therefore the default solution is to provide a wearable radio microphone.

In large lecture theatres there should be four wearable microphones provided. The logic for providing four microphones is that there is less chance of finding the internal batteries of both microphones depleted and the provision of multiple microphones better supports team teaching and/or passing a microphone to students for discussion activities.

The brand and model of microphone specified should be simple to operate and the appropriate operation steps for using the microphone should be included in the teaching station instructions (see Section 3.14).

In the largest lecture theatre spaces, which are often used for mass meetings and events, it is desirable to have additional handheld radio microphones available that can be passed into the audience for pickup of questions/comments.

Across all these spaces there should be an additional single array microphone installed on the teaching station. This microphone will provide a 'fallback' audio pickup in the event that the users forget or don't understand the need to use the wearable microphone(s) or the microphone batteries are not sufficiently charged for use. However it should be noted that an array microphone on the teaching station only provides effective pickup if the presenter remains in close (< 2 metre) proximity to the teaching station.

Installation of gooseneck microphones on the teaching station should not be necessary and should be avoided as they encourage static lecturing styles and potentially cause uneven sound levels if the lecturer does move in and out of its pickup zone.

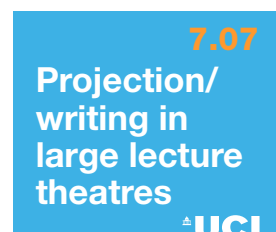
One challenge in larger spaces is facilitating a method for the instructor to write/illustrate and those markings be clearly seen by the students. Conventional whiteboards have a workable height range between 1000mm and 2000mm depending on the height of the lecturer. Column-track mounted boards enable the lecturer to expand this workable height as the lecturer can easily raise a board to make it more visible to students whilst continuing to write on second board below.

In the larger lecture theatres the legibility of material written/illustrated on vertical writing surfaces is constrained for the students furthest from the front by the limit of scale that it is possible to write at with natural fluidity.

Technology can provide solutions to this issue in the following ways:

- use of visualiser as a horizontal writing surface
- use of touch sensitive fixed display monitor (for example Smart Sympodium)
- use of an interactive whiteboard with its display duplicated onto larger projection surface
- use of a portable tablet device with its display mirrored onto larger projection surface (possibly via the fixed teaching station PC)

Evaluation of the advantages and drawbacks of each of these technologies will form a focus for upcoming research by E-Learning Environments to inform the future revision of this document and define the convergence onto a single solution for this issue.



Notwithstanding the technological solutions outlined above, and the likelihood that one of those will become the future recommendation, the most common solution currently utilised in large lecture theatres is column-mounted boards in front of a projection screen. This solution has proved reliable and is an acceptable current solution for refurbishments of lecture theatres. However where space permits additional whiteboard surfaces should be put alongside the main projection surface as many lecturers want to be able to simultaneously project an image whilst drawing or writing on another surface.

7.08 Electronic Voting System

The use of Electronic Voting Systems (EVS), also known as audience /personal response systems or classroom communications systems, has proved popular with both students and staff who have experienced it and its usage is growing both across UCL and the higher education sector as whole. Current technology is based around dedicated battery powered devices. UCL has retrofitted these devices (within a metal security cage) into a number of existing lecture theatres.



above: example EVS handsets installed in a lecture theatre

Other universities deploy EVS solutions that utilize the student's own devices (smartphone, tablet or laptop) and therefore the merit/ justification of installing additional EVS handsets into lecture theatres will need consideration.

If any RF response devices are to be used in the space there needs to be an EVS RF receiver installed. This is a small USB device (similar in appearance to a USB flash memory stick). Due to radio frequency shielding the RF receiver should not be located within the metal security rack holding the other AV equipment. Locating the receiver in a secure location external to the rack by use of a USB extension cable. For larger lecture theatres it is advisable to utilise the 'long range' version of the receiver to ensure consistent connection with response devices in the space.

Section 8: Computer Cluster Rooms

These spaces are defined as having desktop PCs.

Computer cluster rooms are intended to support some or all of the following three functions:

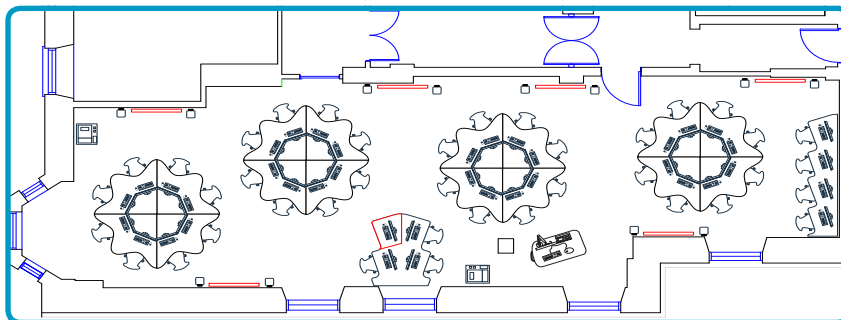
- taught sessions that include a significant element of IT usage by students
- providing computer and associated facilities for self-directed use by students to support their learning
- electronic individual examinations (e-assessment) which are usually taken under invigilation

Some computer cluster rooms perform all these functions at different times whereas some are only used as 'Open Access' facilities and are not bookable to teaching purposes.

The teaching technology within computer cluster rooms that are bookable for teaching should closely resemble that installed in lecture theatres and classrooms with common controls interfaces and layouts. Audio reinforcement and assistive listening technology may be necessary in rooms used for teaching due to the additional ambient noise created by computer fans and the additional HVAC required in rooms with many computers. Lecturecast is not likely to be installed in computer cluster rooms as the sessions should be making use of the computer facilities provided to each student and thus if recordings of screen-based demonstrations are required these should be produced out of the session time.

In computer cluster rooms that are used for taught sessions there should be a distinct teaching position. Where space permits this should be a standardised teaching station as described in Section 3. Given the visual obstruction between the learners and the instructor caused by the monitors/computers it is desirable that the teaching station in this type of room is height adjustable. A visualiser is unlikely to be needed in a computer cluster room and thus should not be installed unless there is a known specific need in the space.

Many of the existing computer cluster rooms are densely packed which provides little opportunity for collaborative learning and makes circulation around other users in the space difficult. Although accommodating the maximum number of workstations in a space is often a priority, the assumption that the density achieved with straight rows is much greater than any other layout should be questioned and alternative layouts investigated.



above: example of a 'petal table' cluster room layout

8.01

The purpose of a computer cluster room

UCL

8.02

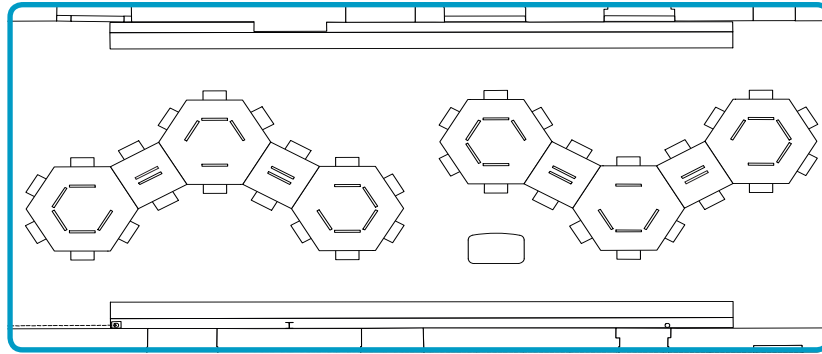
Technology in computer cluster rooms

UCL

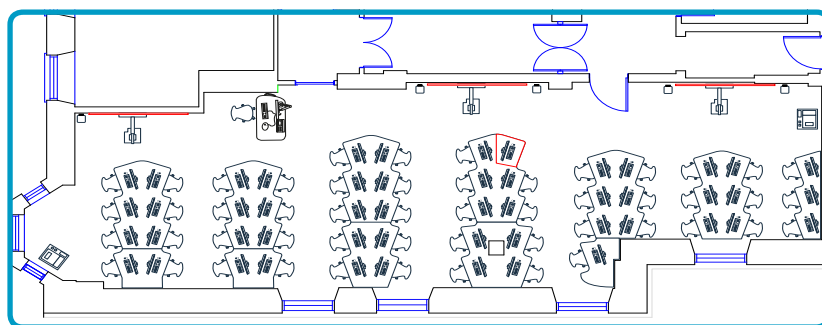
8.03

Layout of computer cluster rooms

UCL



above: example of a 'hexagon table' cluster room layout



above: example of a 'jagged edge table' cluster room layout

The example layouts given here are not shown as templates to be reapplied but instead as examples that suited the particular usage contexts, needs and dimensions in those spaces and may provide inspiration for future work.

8.04 Design of computer workstations



Reference

<http://www.hse.gov.uk/pubns/priced/l126.pdf>

Further guidance

See Appendix 5 for UCL Desk Standards for Teaching and Learning Spaces (cluster rooms)

The physical setup of each computer workstation should aim to ensure both the comfort of the user and, as much as possible, that the user is in the correct ergonomic posture so as to minimise the risk of computer induced medical problems.

Design and dimensions of computer workstations in offices are legislated through the European Display Screen Equipment Directive (90/270/EEC) but

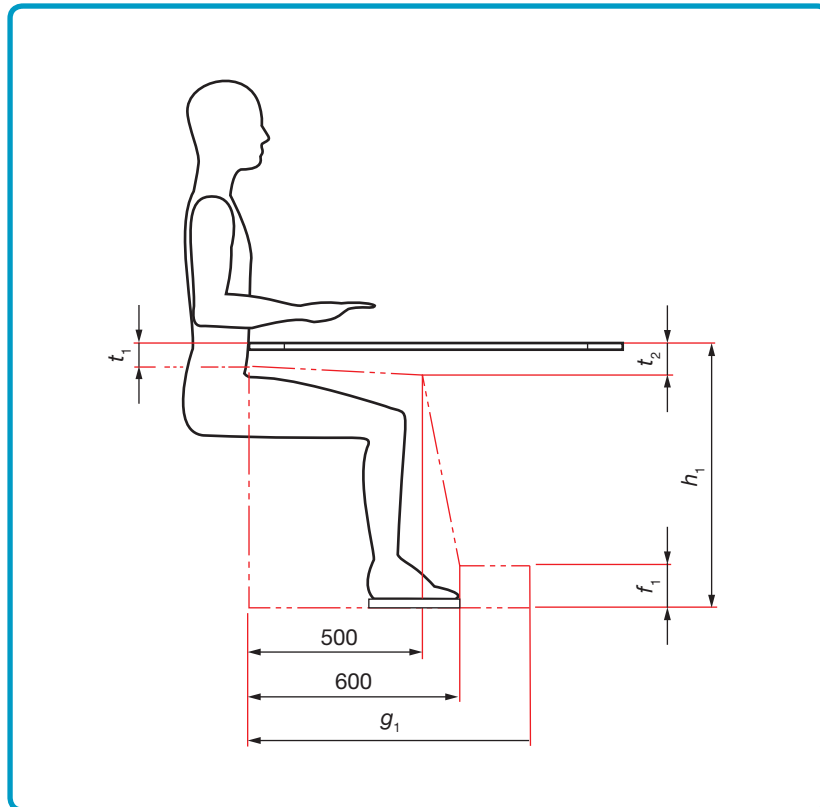
Computer monitors (or the whole computer if an all-in-one unit) should be mounted in such a way to facilitate easy tilt and height adjustment of the display by the user.

Chairs should be standard rotatable, caster-mounted and

Dimensions for workstations should comply with British Standard EN 527-1:2011 which is available to UCL members via the library database directory.

Dimensions			Work table/desk type						
			Type A	Type B	Type C	Type D			
			Fully Adjustable	Fully selectable	Fixed height	Limited adjustable or limited selectable ^e			
h ₁	Height of work surface	Sitting only	Minimum range 650—850	Minimum range 650—850 ^a	740 ± 20	-allow	Min	Max	+allow
						yes	680	760	yes
	Standing only		Minimum range 950—1250	Minimum range 950—1250	1050 ± 20	-allow	Min	Max	+allow
						yes	1000	1180	yes
	Sit/Stand		Minimum range 650—1250	N/a	N/a	Minimum range 680—1180			
t ₁ and t ₂	Maximum desk top thickness	At the front, t ₁	55 ^b	55 ^b	70	70			
		At 500 mm from the front edge, t ₂	80 ^b	90 ^b	100	100			
k ₁	Minimum height of knee clearance for standing position only	Applies only to tables with a height more than 850 mm	700 ^d	700 ^d	700 ^d	700 ^d			
k ₂	Minimum depth of knee clearance for standing position only		80	80	80	80			
k ₃	Minimum depth of foot clearance for standing position only		150	150	150	150			
f ₁ and f ₂	Minimum height of minimum foot clearance	Sitting only and sit/stand From 600mm to 800mm from the front edge, f ₁	120	120	120	120			
		Standing only	120	120	120	120			
g ₁	Minimum legroom depth ^c	Sitting only and sit/stand	800	800	800 ^f	800			
D	Minimum desk top depth ^g		800	800	800 ^f	800			
W	Minimum legroom width	Sitting only and sit/stand	1200	1000	850	850			
		Standing only	790	790	790	790			

Below is key information from BS EN 527-1:2011.



above: BS EN 527-1:2011 seated posture

8.05 Computer considerations

UCL

The choice of computer form factor should be considered in respect to both the aesthetics of the space and the possible negative impact of locating the base unit and security cage under the desk. Large form computer base units located under desks can impinge on leg room when there is a single user but also discourages student collaboration and co-working where two students attempt to sit at a single computer.

Historically the life expectancy of the computer base units was dictated both by the expected electronic reliability/length of warranty support and the period for which the performance of the processor is considered acceptably current and is able to support current software requirements. Typically this has been less than five years.

Since the introduction of widescreen LCD monitors there has been little in the way of evolution of monitors. Now that many LCD monitors have LED backlighting the life expectancy should be greater than previous generations (which tended to go dim after four or five years).

Given the life expectancy of the computer base unit and monitor are comparable now preference should be given to the adoption of 'all-in-one' form factor computers. Typically these provide a cleaner look, with less cabling to conceal (or fail) and are significantly more energy efficient.

All-in-one computers should be installed by mounting them to the desk on an adjustable, spring-balanced, arm with security fixings to prevent unauthorised removal.

Reference

Dell Energy Savings
Calculator

[http://www.dell.com/
content/topics/topic.aspx/
global/products/landing/
en/client-energy-calculator](http://www.dell.com/content/topics/topic.aspx/global/products/landing/en/client-energy-calculator)

As more students bring their own portable devices onto campus the University should consider how these students would benefit from facilities to support their use of these devices. It has been observed that many students choose to use their own devices within computer cluster rooms which can be attributed to the following reasons:

- they are wanting to work in proximity to peers who are doing similar tasks on the provided workstations
- they are wanting to use the multifunction device in the room
- there is no other suitable quiet space to work in

However most existing cluster rooms provide no facility for students to use their own devices. In future redevelopments of PC cluster rooms consideration should be given to including specific 'Technology touch down points'. These are positions where there is space to sit and work at a laptop computer.

There should be two BS1363 socket outlets at the desk height but care needs to be taken to ensure they are not mounted in such a way that prevents insertion of block type power adaptors that extend beneath the socket (a common mistake if the socket plate is mounted in the vertical plane directly on top of a horizontal desk surface). Additionally USB power outlets capable of detecting devices requiring higher power (e.g. iPad which requires 2.1A)

Incorporating a typical 21" widescreen monitor on an adjustable arm above this desk space would add value and comfort for those using their own devices in these spaces. Monitors provided for this purpose should have multiple connectors (VGA and HDMI) on flying leads to the desktop.

The UCL standard multifunction device enables students to scan, print or copy from a variety of devices. Depending on the size of the cluster room there will be either a single or multiple multifunction devices.

When multifunction devices are present special attention should be paid to the storage of paper and printer consumables. Cupboards should be provided for these materials near the location of the multifunction device as should paper recycling collection bins.

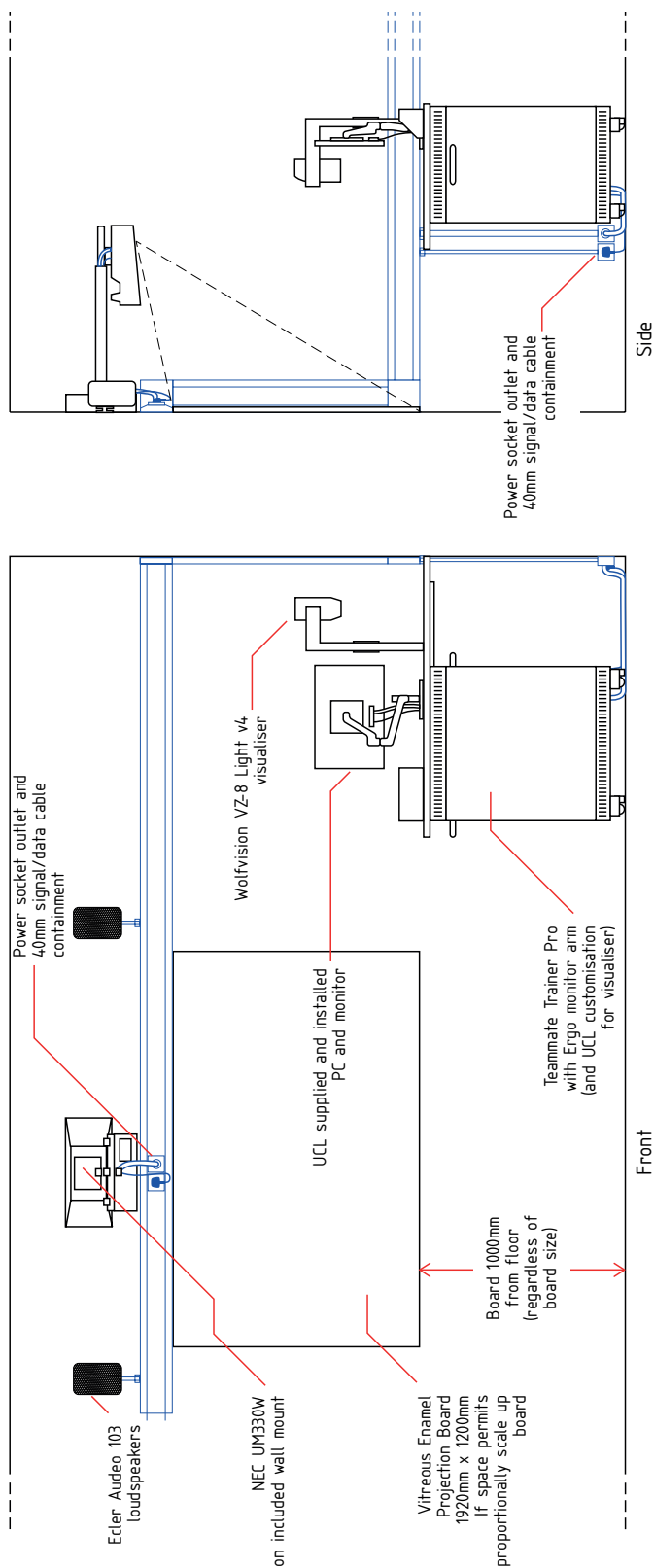
8.05 Technology touch down points



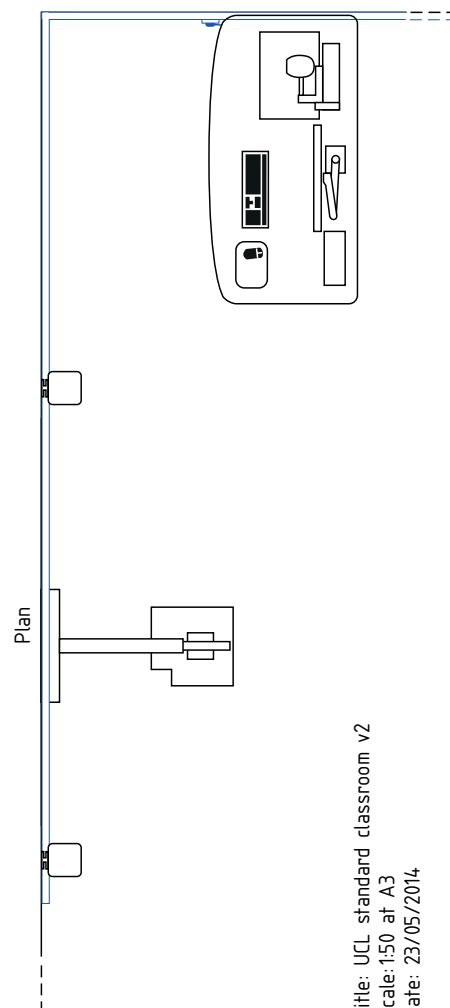
8.06 Multifunction devices



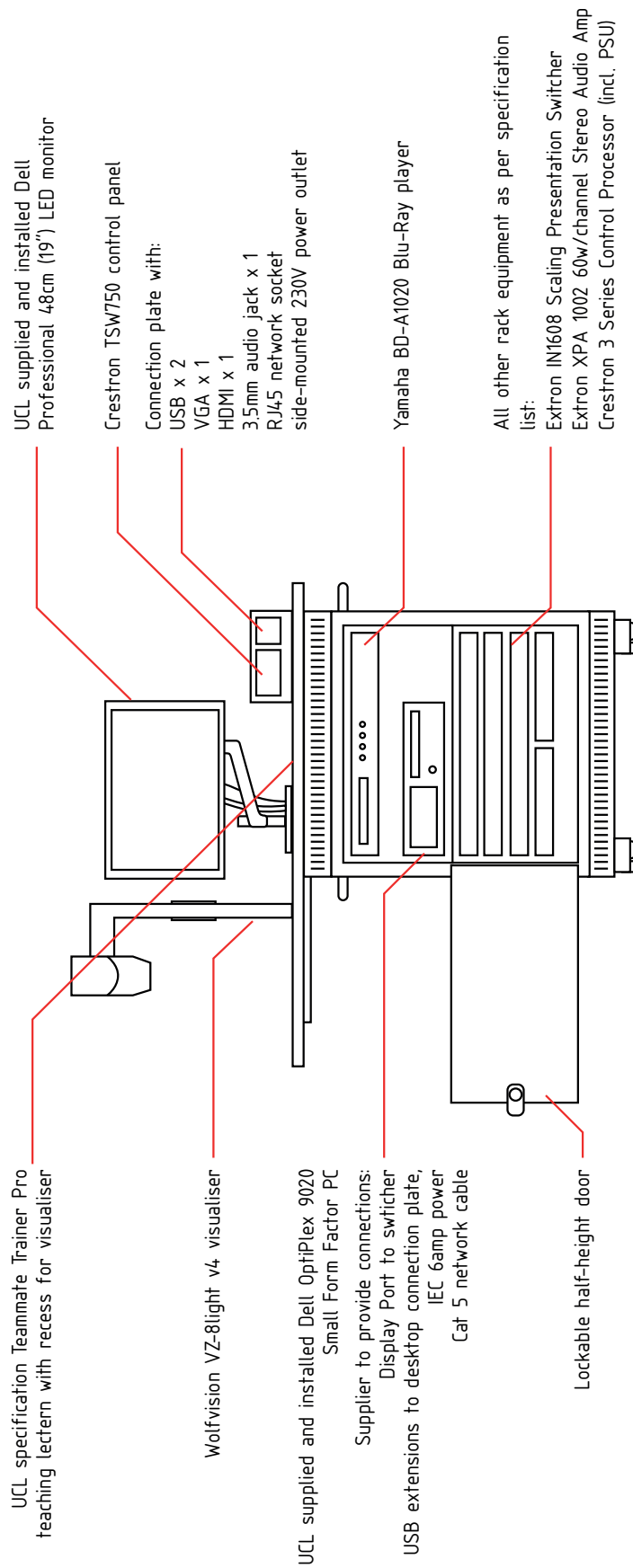
Appendix 1: UCL standard classroom



Note: layout should be mirrored (including teammate configuration) dependant on door location in room



Title: UCL standard classroom v2
Scale: 1:50 at A3
Date: 23/05/2014



Title: UCL standard teaching station
Scale: not to scale
Date: 20/05/2014

Appendix 3: UCL standardised equipment list

Equipment category	Make and model	Comment
Amplifiers and mixers	Extron XPA 1002 Power amp	
	Extron XPA 2001 Power amp	
	Extron DMP-64	
	Extron DMP-128	
Blu-ray player	Yamaha BD-A1020	
Control systems	Crestron TSW-750 Touch panel 7"	
	Crestron TSW-1050 10.1"	
	Crestron MPC-M5	
	Crestron MPC-M10	
	Crestron IRP2 Emitter	
	Crestron CP3 Control System	
	Crestron AV3 Control System	
	Crestron DMPS-300-C	
	Crestron DM-MD16X16	
	Crestron DM-MD32X32	
Electronic voting system	TurningPoint RF	
Induction loop	Ampetronic ILD300	
	Ampetronic ILD500	
HDMI	Extron DTP HDMI 230 Rx	
	Extron DTP HDMI 230 Tx	
	Extron HDMI DA2	
	Extron HDMI DA2	
Lecterns	JM Lecterns PA 10 Wooden lectern. Beech	
	TeamMate Trainer	
	TeamMate Trainer Pro	with UCL customisation to accommodate recessed visualiser
	TeamMate TM Podium Dual	
	TeamMate TM WorksZone	
	TeamMate TM Executive	
	TeamMate TM Totem	
	Top-Tec Voyager2 Bravo Height Adjustable Lectern	
Microphones	Beyerdynamic Revolutio MPR 210	
	Beyerdynamic TG 1000 Dual Receiver	
	Beyerdynamic TG 1000 Beltpack Transmitter	
	Beyerdynamic TG 1000 Handheld Transmitter	
	Revolabs Executive HD 4 channel wireless microphone system	
	Revolabs HD Single/Dual channel wireless microphone system	
Projectors	NEC UM330wi	
	NEC M311w	
	NEC P451w	
	NEC PA550w	
	Epson EB-Z8350w	
Security/Mounting	Unicol CP1 ceiling plate	

Equipment category	Make and model	Comment
	Unicol Pole	
	Top-Tec 105-SUMP-2	
	Unicol Double Swing Arm	
	Unicol Xactmatch Tilting Plasma / LCD Mount	
	Unicol VS1000 Plasma stand	
Speakers	Ecler Audeo 103	
	Ecler Audeo 106	
	Ecler Audeo 108	
	Ecler Dacord H206i	
	Ecler Dacord T208i	
	Ecler IC8	
Switcher	Extron DVS 605 A	
	Extron IN 1608	
	Extron IN 1608 SA	
Visualiser	Wolfvision VZ8 Light v4	





Problems or Faults: Call AV Service Desk on 46677 or send an e-mail to servicedesk@ucl.ac.uk

AV: Quick Start Guide

To turn on the AV equipment:




To use the PC:

Select the PC icon on the control panel.

If the PC image is not projected/shown on the monitor ensure the PC is turned on by checking for a green light on the PC (located in the equipment rack) and that the monitor is turned on (blue light in the bottom right corner of the monitor).

Log onto the PC using your UCL credentials or the guest login facility.

To use your own laptop:

Connect your laptop using cables either the VGA lead (provided) or an HDMI lead (not provided). If you require audio playback from the laptop connect the 3.5mm jack lead into the headphone output of the laptop.

Press the LAPTOP button on the touch-screen panel.

Ensure the laptop is displaying via its external output. On most laptops this is indicated by a symbol on one of the function keys at the top of the keyboard. On Window laptops it is most commonly FN+F5 or FN+F8. Toggle through the display options until the computer displays on both the main display and the laptop screen. On Apple laptops go to 'System Preferences' then 'Displays' and finally 'Arrangement' to enable 'Mirror Displays'.

To use the video player to play optical discs:

Touch the DVD button on the control panel. The type of video player provided currently varies as VHS is phased out. The optical disc players provided can play most types of disc including:

- UK BluRay
- UK DVD
- CD audio discs

Standard playback control buttons will appear on the control panel.

To use the document camera:



If the document camera arm has been lowered, raise the arm fully using light grey tab on the arm.

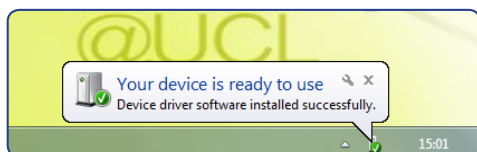
Press the power button on document camera and then touch the DOC CAM button on the control panel.

You can use dry erase pens on the writing surface.

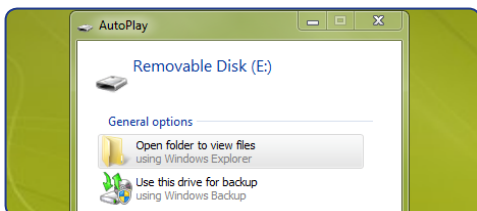
Accessing your files on the PC

Using a USB flash drive

After logging into the PC, plug your USB flash drive into a USB port on the PC. A message will appear stating that 'Your device is ready to use'.

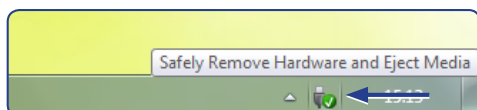


You may then get a pop-up box which will give you a few options. You will need to select the option 'Open folder to view files'.

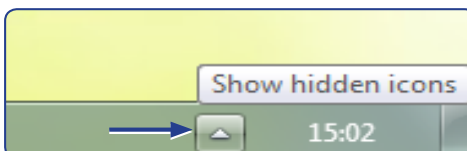


Removing your USB flash drive

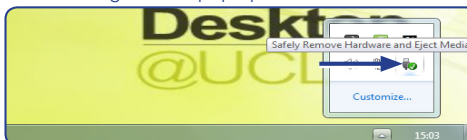
To remove the flash drive, you must eject the device first. Click on the USB icon in the bottom right hand corner of your screen.



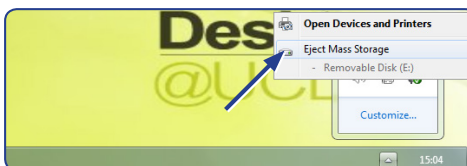
However if the USB icon is hidden you will need to select the arrow to show hidden icons.



The following box will pop up.



Select the USB icon and a list of removable storage devices will be displayed.



Select the storage device you wish to eject. A message will appear stating 'device can now be safely removed from the computer'.



Note: Encrypted USB flash drives will not work on Desktop@UCL.

Accessing your network 'Home' directory

To access files in your Home directory simply click on the 'My Documents' shortcut on the desktop.



Problems or PC Faults: Call ISD Service Desk on 25000 or send an e-mail to servicedesk@ucl.ac.uk

above: example teaching station user instructions (rear)

Desk Standards for Teaching and Learning Spaces (cluster rooms)

Desk Types

Standard Desk

The standard desks used in most of the existing Teaching and Learning spaces have the following dimensions:

Height: 700mm

Length: 700mm

Width: 1000mm

Thickness: 20mm

These desks can be used against a wall or as part of a group free standing within the room.

Mini Tower or Ultra Small factor PC's have be used with this type of desk in the past but going forward the default deployment will be an all-in-one PC and Monitor.



<All-In-One Photo>

Wall Benching

This is type of desk is being used in open access / kiosks areas in the new spaces implemented post summer 2012 and typically use Ultra Small Form Factor PC's.

Height (low): 700mm

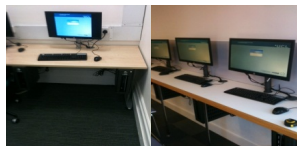
Height (high): 995mm

Length: 700mm

Width (low): 1000mm

Width (high): 515mm

Thickness: 20mm



LOW

HIGH

Security Cages and Monitor Brackets

Mini Tower Cages

Mini Tower cages are used in most of the existing learning and teaching spaces.



Dalen Product Name : 418-UCL04
Dalen Product Price £150.00
Dimensions : 510mm length x 520mm height x 230mm width

Ultra Small Form Factor Cages

Ultra Small form factor cages are used in new teaching and learning spaces and are preferred as they use the desk space more effectively.



Dalen Product Name: #418Z-UCL06-GY-SK
Product Price: £118.30
Dimensions: Length 315mm x Height 340mm x 125

Monitor Brackets

Monitor Only

The standard monitor only bracket that is used on all desks they both height adjustable and tilt capable.



Dalen Product Name: 485V3-SR-SK Uni FS Brckt with Tilt Swivel Height Adjust
Product price: £77.00

All-In-One PC

The Endo 82 arm should be used for new and existing spaces that will use the all-in-one PC solution. The All-in-One solution saves on space as there is no need for a separate PC. The solution also uses less cables which produces a more aesthetic experience. The versatility also means they are able to be installed in area's in which a PC, Monitor and Security cage are not suitable.



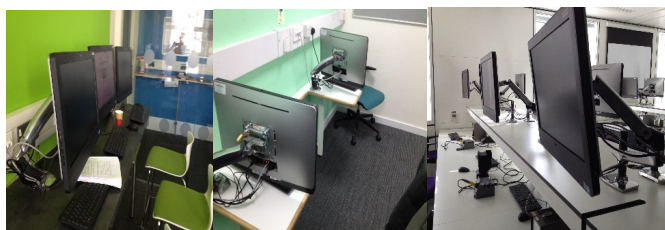
Dalen Product Name ENDO82 Desk Mounted Universal Articulated LCD Arm
Product Price: £131.20

Lead Times

- Cage and Monitor bracket order and delivery (16 days).
- Cage and Monitor bracket fitting (1 day)

Examples of All-in-One PC's

All in one PC's can be fitted to normal style tables as you would with a monitor bracket. They can also be fitted to benching, bespoke tables and above desk level as shown below.



All-in-One Security

All-in-One PC's should be fitted with a VESA bar and padlock for security as shown.



Dalen Product Name: 492-VESABAR Vipa VESA Bar
Product price: £16.00

Trunking - Power and Data Presentation

Above the table for mini towers or Ultra Small Form Factor PC's and All-in-Ones

Ideally trunking should be 60mm above the desk with power situated behind the monitor bracket with 1/2/4 Data points situated to the left of the power socket as shown.



Below the table for mini towers or Ultra Small Form Factor PC's and All-in-Ones

For Ultra Small PC's Trunking should be 60mm below the table .Power should sit behind the cage with the data points to the right or left of this by 20mm..



Below the table

For Mini Towers Trunking should be 60mm below the table power situated to the right or left of the cage.



Things to Avoid

Data and Power presentation to avoid

Data and power all presented at one end of a row of desk or benching should be avoided. Although this can be cheaper there are several problems with this: -

- 1) Power extension blocks are needed to get power to all tables. These usually have to be fixed to the desks, either to the table by screws or to the back of the desk with cable ties. These can often fall off or come loose.
- 2) Longer power and data leads are needed. This adds significant amounts of time to an install of a space as cable tying takes longer and is more complex. After the install of the space any fault finding/trouble shooting is more complex.
- 3) If one power switch is turned off it will disable the whole row as this will cut the power to the extension blocks.
- 4) It is less aesthetically pleasing than other options.



Other relevant UCL guidance

UCL Fire Safety Technical Notes & Mandatory Instructions
<http://www.ucl.ac.uk/estates/maintenance/fire/documents/>

Further information

Association of Educational Technology Managers (Australia) “AETM Design Guidelines for Tertiary Teaching Spaces: 2nd Edition”:

http://www.aetm.org/uploads/media/AETM_Audio_Visual_Design_Guidelines_2nd_Edition.PDF

JISC's 2006 publication “*Designing spaces for effective learning: A guide to 21st century learning space design*” plus further multimedia resources:

http://www.jisc.ac.uk/eli_learningspaces.html

JISC Infonet Flickr photostream showing many images of UK university learning spaces:

<http://www.flickr.com/photos/jiscinfonet/sets/>

Learning Space Rating System, Educause project that provides a set of measurable criteria to assess how well the design of classrooms support and enable active learning activities:

<http://www.educause.edu/eli/initiatives/learning-space-rating-system>

Educause Learning Space Toolkit “*A Resource for Designing and Sustaining Technology-Rich Informal Learning Spaces*”:

<http://learningspacetoolkit.org>



